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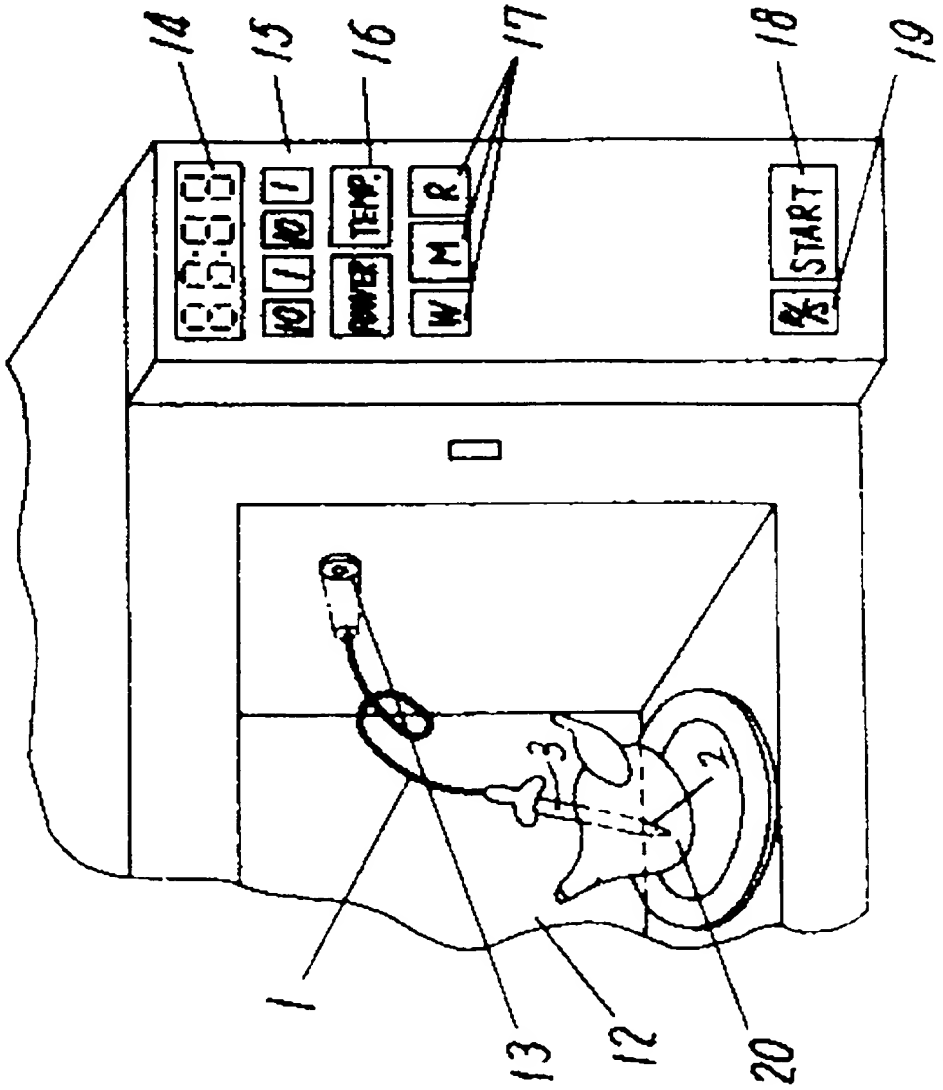
(54) HIGH FREQUENCY HEATING DEVICE

(57) Abstract:

PURPOSE: To speed up a speed cooking by the high frequency heating device and to provide a good dish with a good appearance by a method wherein the temperature of food is detected at both the center part and surface part by a single probe, and the output of the high frequency heating device is controlled based on the detection results.

CONSTITUTION: The high frequency heating device comprises a heating chamber 12 for housing food 20, a high frequency oscillator to supply high frequency into the heating chamber 12, the sensor probe 1 to detect the temperature of the food 20 and a control circuit including a microcomputer to control the high frequency oscillator based on the detection signal of the sensor probe 1. The sensor probe 1 is attached at different points with two heat sensing elements 2 and 3 and a difference temperature detected by the two elements 2 and 3 is used to control the output of the high frequency oscillator. As a result of this, the speed cooking by the high frequency heating device is further speeded-up, and a good dish with a good appearance can be provided.



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F 24 C 7/08　6513—3L

発明の数　1
審査請求　未請求

（全 3 頁）

⑤4高周波加熱装置

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⑳特　願　昭56—186283
㉒出　願　昭56(1981)11月19日

1

明　細　書

1、発明の名称

高周波加熱装置

2、特許請求の範囲

(1) 食品を収納する加熱室と、前記加熱室内へ高周波を給電する高周波発振器と、前記食品の温度を検知するセンサプローブと、前記センサプローブの検知信号により前記高周波発振器を制御するマイクロコンピュータを含む制御回路とを備え、前記センサプローブは異なった位置に設けられた2個の感熱素子を有するとともにこのセンサプローブの検知する温度差により前記高周波発振器の出力を制御してなる高周波加熱装置。

(2) センサプローブに設けられた感熱素子の離間距離を40㎜以上とした前記特許請求の範囲第1項記載の高周波加熱装置。

3、発明の詳細な説明

本発明は電子レンジ等の高周波加熱装置に関するものである。

従来の高周波加熱装置には1個のセンサプローブ（以下プローブと称する）が組込まれており、プローブの先端部分にサーミスタ等からなる温度感知部があり、例えばローストビーフ等の中心部にそのプローブを挿入し、温度感知部の温度が設定した温度になった時、自動的に調理が完了する。あるいはマイコン等を使用した機器では、第1の設定温度になった時、出力を変えて第2の設定温度まで加熱し、第2の設定温度に食品の温度が達した時に調理が完了するものもある。

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以上の構造の高周波加熱装置では、ローストビーフの中心部の温度により、調理の出来具合を制御しているため表面部分の出来具合が無視され過加熱が生じ表面が焦げつき炭化してしまうことがあった。

これは第1図Aに示す様に一般に高出力で加熱すると中心が生であるのに表面が焦げ出す。逆に低出力で加熱すると同図Bに示すように表面部分と中心部の温度差が小さく仕上がるが加熱に要する時間は長時間となる。第1図A，Bにおいて、Kは焦げ部，Wはウエルダン部，Mはメディアム

部，Rはレヤー部，Nは生部をそれぞれ示す。

このように表面部分の過加熱を防ごうとすると出力を下げて調理すれば過過加熱（熱伝導により温度が平準化される意味）によりうまくいくが、必要以上に長時間を要することになる。また肉の大きさにより最適条件が変る為、短時間で出来上る肉の場合でも、低出力で長時間加熱することになり、時間の短縮化が課題であった。

本発明の目的は、高周波加熱装置でセンサプローブを使用して、食品の加熱状態（出来上り状態）を制御しようとするもので、高周波加熱装置のスピード調理をさらにスピードアップし、見栄えのよいおいしい調理が可能である高周波加熱装置を提供するものである。

以下本発明の一実施例につき、図面に基いて説明する。

第２図において、１はプローブで第１の感熱素子２と第２の感熱素子３を挿入部４に設けている。５はプローブ１を肉等の食品に挿入するためのグリップ，６はシールド線からなる３芯シールド線，７は制御装置に信号を送るプラグ，プラグ７の表面８はアースである。また表面８に連設する端部９および先端部１０はそれぞれ第１の感熱素子２と第２の感熱素子３に電気的に結線されている。また第１と第２の感熱素子との間隔（寸法ａ）は４０㎜程度が合理的であることがわかった。理論的には感熱素子であるサーミスタ等の数を増やせばさらに細かい加熱制御が出来るが制御装置およびプローブの構造が複雑になる割には顕著な効果がなく、上記実施例のように感熱素子は２個の場合がコストパーフォーマンスから考えて合理的である。

第３図において、本発明の一実施例である高周波加熱装置を示し、１２はオーブン庫，１３はプローブ１のソケット，１４は時間又は温度等を表示する表示部で、１５は数字キー，１６は機能キーをそれぞれ示し、高周波出力やプローブ１の温度設定を行う。１７は出来上り状態キーで、例えばこんがり焼きＷ（ウェルダン）から半生焼きＲ（レヤー）まで３段階に選択できる。１８はスタ

ートキー，１９はストップあるいはリセットキーである。

以上の構成における本装置の動作について説明する。今、食品２０にミートプローブ１を挿入しオーブン庫１２内に入れプローブ１のプラグ７をオーブン庫１２内のソケット１３にセット（挿入）する。ドアー（図示せず）を閉じコントロール部のキー１６の Temp を押し３つの出来上りキー１７のどれかを選びスタートキー１８を押す。本装置の制御装置に設けられたマイクロコンピュータには、例えば次のプログラムをあらかじめ組み込んでおく。「食品の初期の中心温度（10℃）および表面部温度（10℃）を記憶し、加熱に伴ない表面部温度がT_1（30）℃上昇した時には高周波発振器（図示せず）の出力を高出力（700W）から低出力（300W）に下げ、さらに中心温度がT_2℃(30℃)以上でかつ表面温度がT_3（50）℃以内の上昇であれば再度高出力（700W）をかけ、表面温度がT_4（50）℃以上に上昇した時点で高周波発振を停止する。」

このようなあらかじめマイクロコンピュータに組み込まれたプログラムによって、自動加熱調理が進行されるわけである。

以上のように中心部温度と表面部温度とが１つのプローブにより検出され、その両方の温度の状況から高周波出力を制御するので、食品全体がバランスよく均一に加熱されまた見栄えの非常によい調理加熱ができる。

上述の「中心温度と表面部の温度差」あるいは「ある一定以上の中心温度と表面部温度差」等による出力制御のプログラムは一例であり、出来上りキーの種類を増やすことにより、きめ細かいプログラムが可能であり、複雑な調理を良好な仕上りでもって自動調理することができる。

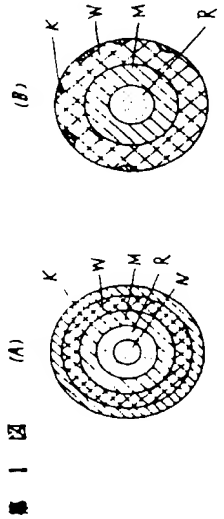
以上のように本発明によれば、従来の構成を複雑にすることなく１つのプローブで食品の中心部と表面部の温度を検出し、高周波出力を制御するので仕上りが非常に均一でしかも見栄えがよいとともに使い方も簡単で使い勝手のよい高周波加熱装置を提供することができる。

4、図面の簡単な説明

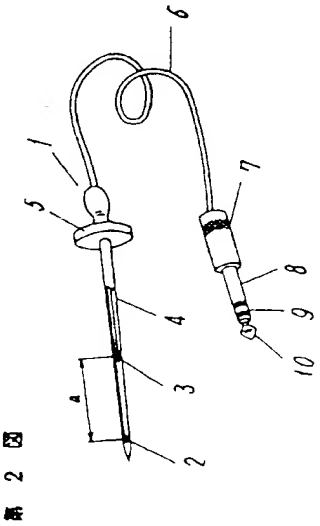
第1図A，Bは従来の高周波加熱装置での食品の出来上り状態を示す断面図、第2図は本発明の高周波加熱装置のセンサプローブを示す外観斜視図、第3図は同装置の要部外観斜視図である。

1……センサプローブ、2……第1の感熱素子、3……第2の感熱素子、12……オーブン庫（加熱室）。

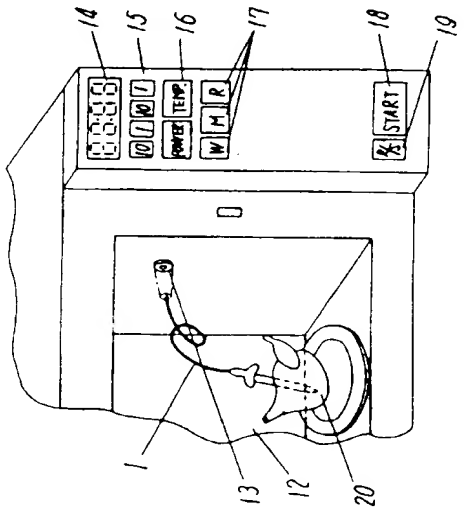
代理人の氏名　弁理士　中　尾　敏　男　ほか1名



第1図



第2図



第3図

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(51) Int.Cl.[3] Class'n code Int.Ref.No. (43) Laid Open: 14.06.1983

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Examination: Not requested
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(54) Title of Invention: High-frequency heating device

(21) Application No.: 56-186283

(22) Date of Application: 19 November 1981

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at Matsushita Denki Sangyo K.K.
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(74) Agent: Patent Attorney K. Nakao and one other

Specification

1. Title of Invention

High-frequency heating device

2. Claims

(1) A high-frequency heating device provided with a heating chamber that accommodates food, a high-frequency oscillator that supplies high-frequency waves to said chamber, a sensor probe that detects the temperature of said food, and a control circuit containing a microprocessor which controls said high-frequency oscillator with the detection signals from said sensor probe, and which, in addition to said sensor probe having two heat-sensing elements provided at different positions, controls the output of said high-frequency oscillator according to the temperature gradient detected by this sensor probe.

(2) A high-frequency heating device according to Claim 1, in which the distance separating the heat-sensing elements provided on the sensor probe is 40 mm or greater.

3. Detailed Description of the Invention

The invention relates to a high-frequency heating device such as a microwave oven.

Conventional high-frequency heating devices incorporate a single sensor probe (hereinafter referred to as "the probe"), there being a temperature detecting portion such as a thermistor in the tip portion of the probe, and with the probe inserted into the core part of food such as roast beef, for example, the cooking automatically terminates when the temperature-detecting portion reaches the set temperature. Alternatively with equipment that employs a computer, there is also a method whereby when a first set temperature is reached, heating continues at a different temperature until a second set temperature is reached, the cooking terminating when the food has reached the second set

temperature.

Because the progress of the cooking is controlled by the temperature at the core of the roast beef with a high-frequency heating device of the above structure, the surface can become burnt and blackened due to overheating since the condition of the surface is ignored.

As is shown in Fig. 1A, what generally happens when heating with a high output is that the surface ends up burnt, although the centre is still uncooked. At the opposite end of the scale, as shown in Fig. 1B, although heating at a low output allows the process to be completed with a small temperature gradient between surface and core, a great deal of time is required for the cooking. In Figs. 1A and B, K indicates the burnt portion, W the well-done portion, M the medium-done portion, R the rare portion and N the uncooked portion.

When attempting to prevent this overheating of the surface portion, things can be improved by reducing output during cooking with "brought-forward" heating (meaning that the temperature is levelled out through thermal transmission), but as a consequence an unnecessarily long time is required. Moreover as the optimum conditions change according to the size of the piece of meat, meat that can be cooked in a short time may be heated for a long period at a low output, and the question of how to shorten cooking time remains.

The purpose of the invention is to provide a high-frequency heating device which controls the way the food is heated (the way it is cooked) using a sensor probe, increases the speed of cooking in a high-frequency heating device still further, and enables tasty and good-looking dishes to be produced.

An embodiment of the invention will now be described

with reference to the drawings.

In Fig. 2, 1 is a probe with first heat-sensing element 2 and second heat-sensing element 3 provided on insertion portion 4. 5 is a grip for inserting probe 1 into food such as meat, 6 is a 3-core shielded cable comprised of shielded cable, and 7 a plug which sends signals to the control device, with surface 8 of plug 7 acting as an earth. Furthermore, terminal 9 and tip terminal 10 which are contiguous with surface 8 are electrically coupled to first heat-sensing element 2 and second heat-sensing element 3 respectively. It has been found that the optimal distance between the first and second heat-sensing elements (dimension a) is around 40 mm. Whilst in theory an increase in the number of thermistors that comprise the heat-sensing elements would permit more delicate control of the heating, the results are not proportionate to the additional complication in the structure of the control device and probe, and the use of two heat-sensing elements as in the above embodiment has been found to be optimal from the point of view of cost performance.

Fig. 3 shows a high-frequency heating device of an embodiment of the invention, 12 being an oven, 13 a socket for probe 1, 14 a display unit for displaying time or temperature, 15 the number keys, and 16 the respective function keys, where the temperature setting of probe 1 and the high-frequency output are set. 17 are the cooking control keys, which permit a selection from three stages from thorough roasting W (well-done) to half-cooked R (rare). 18 is the start key, 19 the stop or reset key.

The operation of a device of the above structure will now be described. Meat probe 1 is inserted into food 20, placed within oven 12, plug 7 of probe 1 being set (inserted) into socket 13 within oven 12. The door (not shown in the figure) is closed, the Temp button of

control keys 16 is depressed, a selection made from one of the three cook control keys 17, and start key 18 depressed. The microcomputer provided in the control device of the invention may be programmed in advance with the following programme, for example: Memorize initial core temperature (10°C) and surface temperature (10°C) of the food, and when the surface temperature reaches T_1 (30)°C as the heating progresses, reduce the output of the high-frequency oscillator (not shown in the figure) from a high output (700 W) to a low output (300 W), and where the temperature of the core is more than T_2°C (30°C) and the surface temperature is less than T_3 (50)°C, reapply the high output (700 W), shutting off the high-frequency oscillator at the point where the surface temperature goes above T_4 (50)°C.

It is thus possible to carry out automatic heating and cooking using a programme that has been programmed into the microcomputer in advance in this way.

As the core temperature and the surface temperature are detected by a single probe in the way described, and the high-frequency output is controlled on the basis of both these temperatures, it is possible to ensure that food is uniformly heated throughout in a balanced way, producing good-looking and very tasty dishes.

The output control programme described above using elements such as "the temperature difference between the core temperature and surface" or "the temperature difference between the core temperature and surface beyond a certain point" is merely an example, and by increasing the number of cooking control keys, a more precise programming is possible, enabling complex recipes to be cooked automatically to a satisfactory standard.

Thus according to the invention it is possible to provide a high-frequency heating device in which the

temperature of the core portion and the surface portion of the food is detected with a single probe without a more complicated structure than in conventional devices, and as the high-frequency output is controlled, dishes are cooked very uniformly and moreover look good, and in addition the device is easy to operate and to use.

4. Brief Description of the Drawings

Figs 1A and B are a cross-section showing the way in which food is cooked in a conventional high-frequency heating device. Fig. 2 is an oblique external view showing the sensor probe of the high-frequency heating device of the invention. Fig. 3 is an oblique external view showing the main parts of the same device.

1...sensor probe, 2...first heat-sensing element, 3... second heat-sensing element, 12... oven (heating chamber).

Agent: Patent Attorney K Nakao and one other

Figure 1

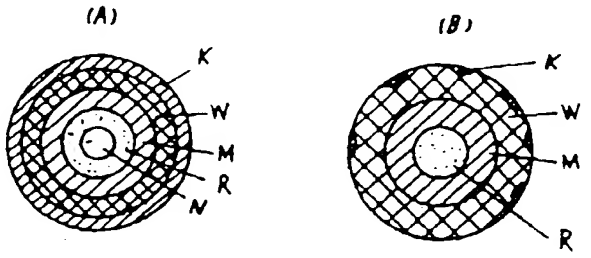

Figure 2

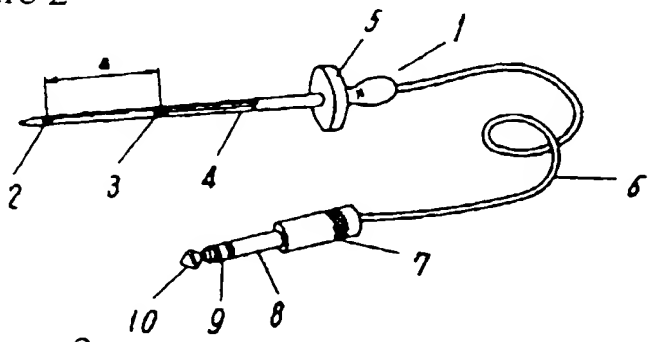

Figure 3